DRAFT ***** DRAFT ***** DRAFT

6/15/93

Action Plan for 1994 - 1998 to Inventory and Monitor the Effects of Air Pollution on Air Quality Related Values in Otter Creek Wilderness and Dolly Sods Wilderness of the MONONGAHELA NATIONAL FOREST

INTRODUCTION.

Under responsibilities assigned to it by the Clean Air Act, the USDA Forest Service reviews permit applications for major new sources of air pollution, and major modifications of existing sources which are located near the Class 1 areas under its jurisdiction. This Prevention of Significant Deterioration (PSD) process of the Clean Air Act provides an opportunity for the Forest Service to interact with the State regulatory process to protect the Air Quality Related Values (AQRV's) of the Class 1 areas.

In order to meet this obligation, managers of the Monongahela National Forest recognize the need to increase our knowledge and understanding of the kinds and amounts of air-related pollutants impacting the Class 1 areas, and the current and potential effects of air pollution on the AQRV's in those areas. The Class 1 areas within the Monongahela National Forest are the Otter Creek Wilderness and the Dolly Sods Wilderness. A general USDA-Forest Service Eastern Region method for reviewing PSD permit applications was published in 1991, entitled Screening Procedure to Evaluate Effects of Air Pollution on Eastern Region Wildernesses Cited as Class 1 Air Quality Areas. This action plan supplements that publication, by identifying site specific information needs which will provide for effective application of the screening procedure.

This action plan was developed from information gathered at a workshop held in February 1993 involving 35 participants (Appendix 1) including scientists, Forest Service managers and specialists, representatives from US-EPA Region 3, and representatives from West Virginia, Maryland and Virginia state air regulatory offices. The first day of the workshop was spent summarizing and reviewing information about the PSD process and the present state of scientific knowledge about the Class 1 area resources and the pollutants affecting them. The remainder of the workshop was spent developing products for an action plan that addresses the stated workshop objectives. Those objectives were:

1. Identify sensitive indicators for the air quality related values, and the pollutants that affect them.

2. Identify inventories needed to characterize present conditions of the sensitive indicators for the air quality related values.

3. Develop methods to detect changes and trends in the condition of those sensitive indicators (long-term monitoring).

Workshop Objective 1: Identify sensitive indicators and the pollutants that affect them.

TERRESTRIAL INDICATORS.

Indicators	Pollutants
* Foliar injury: black cherry, milkweed, elderberry poplar, white ash, viburnum.	Ozone
* Foliar nutrients. Red Spruce.	S & N, metals
* Tree rings.	O, S & N, metals
* Peat cores.	S & N, metals
* Amphibians	S & N, metals
* Lichens.	S & N, metals
* Insects: "lichen" insects (rare, disjunct lepidoptera). soil insects. "juice feeders"--interactions.	O, S & N, metals
* Threatened and Endangered Species Cheat Mountain Salamander Virginia Northern Flying Squirrel	S & N, metals
* Soil chemistry/ aluminum in soil.	S & N, metals
* Nitrogen saturation of soils	N
* Visibility (IMPROVE).	O, S & N

AQUATIC INDICATORS.

Indicators	Pollutants
* Precipitation chemistry (may be adequately covered by existing monitors.	S & N
* Water chemistry. ANC, pH, aluminum (inorganic monomeric and total dissolved Al), DOC, anions, cations, silica, conductivity, volume/flow regimes.	S & N
* Soil water chemistry. (Same parameters as for surface water.)	S & N
* Aquatic vegetation. Wetland diversity. Algae.	S & N, metals
* Fauna. Fish: community characteristics Macroinvertebrates. Amphibians.	S & N, metals

Workshop Objective 2: Identify inventories needed to characterize present conditions.

First time measurements in esisting data sets are baseline for the indicators. Subsequent measurements taken for indicators may be compared to the baseline data and is considered monitoring data.

TERRESTRIAL INVENTORIES.

When it is feasible we will measure every terrestrial AQRV indicator parameter. If this is not possible we will design inventories for representativeness of terrestrial indicator conditions.

Action Item 1a. Inventory the composition, structure and health of the vegetative communities within each of the Class 1 areas. (Ecological Classification System may do some of this).

Who: (ECS) - Monongahela National Forest; (Permanent Plots) - FHP/FHM assistance.

What: The Monongahela National Forest should give initiation of ECS in Class I areas priority consideration. Establish permanent vegetation plots to include sampling of bryophytes, lichens, herbs, shrubs, and woody species in each of the major plant communities. Use this plot system as the framework for other aspects of inventory and monitoring (soils, foliar/crown conditions). Include species, age distribution,... (archive tree cores).

Cost/$: $50K

Priority: 1a.

Action Item 1b. Determine the range and location of primary soil types in each Class 1 area.

Who: Monongahela NF, Soil Conservation Service.

What: Map soil types in each wilderness area. Traditional SCS mapping techniques. Soil samples will be collected by horizon at a minimum of 2 samples per major soil type.

The baseline chemical analysis is a part of the aquatic action plan.

Cost/$: Probably $10-20K.

Priority: 1b.

Action Item 2. Inventory fauna that may be affected by air pollution, especially threatened, endangered and sensitive species.

Who: Contractors. (F&WL Service, West Virginia DNR, University).

What: Amphibian inventory, with emphasis on Cheat Mountain Salamander. Large scale inventory of insects, with intensive inventory of lichen-eaters: Collembola, Machilidae, Hypoprepia caterpillars. Some of the larger-scale inventories may be developed from existing species lists.

The Virginia Northern Flying Squirrel.

Cost/$: Salamanders and Virginia Northern Flying Squirrel $15K
Insects $20K

Priority: 2.

Action Item 3. Inventory lichen populations.

Who: Contractor. (University).

What: Inventory lichen populations to include community structure, species abundance and elemental composition for the range of substrates and ecosystems. Use permanent photo points to document lichen condition and cover.

Cost/$: $20K

Priority: 3.

AQUATIC INVENTORIES.

If possible, measurements should be taken for all streams, ponds and vernal pools in the Class I areas. Where it is not feasible to inventory all streams and ponds the major ones should be measured. If it is not practical to sample all vernal pools then measure those representative of a broad cross-section of wilderness features and conditions, such as soils, geology, elevation, deposition, etc.

Existing stream and pond data from wildernesses, and from Middle Atlantic sites similar to those in wilderness, should be evaluated for effects on important inventory parameters that may be representative of the Class I areas.

Action Item 1a. Conduct a synoptic (overview) survey of water quality (water chemistry) in all streams of both Class 1 areas.

Who: Monongahela NF will initiate a contract with a university or consultant.

What: Basinwide sampling of sensitive aquatic indicators in the watersheds of Otter Creek and Dolly Sods wildernesses for all parameters identified as being important. See sensitive indicators list.

How Often: Once. But may want to repeat in 5 years.

Cost/$: $10K

Priority: 1.

Action Item 1b. Analyze information from action item 1a, together with information on controlling landscape and the geochemical environment.

Who: Monongahela NF and other capable group. May be USFS Research, University, Park Service or others.

What: Determine relationship between streamwater chemistry and the controlling landscape. Establish response classes that reflect variability in geochemical environment. Select stream systems (representing those classes) for biological and habitat inventories, long-term monitoring of biota, chemistry, and streamflow (including episodes).

How Often: Once.

Cost/$: $30K

Priority: 1.

Action Item 2. Determine the chemical composition of soil and soil water.

Who: Monongahela NF in cooperation with USFS Research or University.

What: Characterize soil and soil water chemical composition.
If possible measure ANC, pH, aluminum (inorganic monomeric and total dissolved), DOC, anions (SO_4, NO_3, Cl), cations (Ca, Mg, K, Na), silica, conductivity, and sulfate adsorption capacity.

Make determinations within response classes, landscape units (ECS) (probably at the subsection or ecological land type association level) in the Class 1 areas. May want or need to look at applicability of adjacent/similar areas, or data collected from adjacent/similar areas, for soil water if sampling cannot be done within the wilderness areas.

How Often: Soil water, multiple times (seasonally) in a year.
Sulfate adsorption, once.
Soil chemistry, once.

Cost/$: Estimated cost $20-25K.

Priority: 2.

Action Item 3a. Inventory fish for species presence and abundance.

Who: National Forest, USFS Research at VPI, (perhaps in conjunction with habitat survey) and US Fish and Wildlife Service.

What: Quantitative inventory in conjunction with habitat survey.

How Often: Once (initially).

Cost/$: Dollars included with habitat survey activities (Action Item 4).

Priority: 3a.

Action Item 3b. Inventory presence and abundance of amphibian species.

Who: Contractor/University.

What: Inventory presence and abundance of amphibian species in both Class 1 areas, on a sample of the following aquatic types. Concentrate on eggs and larvae, but also include adults.

* Streams, first and second order streams.
* Vernal pools.
* Wetlands, use Fish and Wildlife maps.

How Often: Once each in spring and later in summer.

Cost/$: $5-6K.

Priority: 3b.

Action Item 3c. Inventory macroinvertebrate community based on habitat survey results.

Who: Contractor (University). USFS may be trained for collection.

What: Inventory macroinvertebrate community present based on habitat survey results. (Qualitative inventory). Characterize communities by pH level.

How Often: Once in the spring. (??)

Cost/$: Cost estimate is uncertain.

Priority: 3c.

ACTIVITIES RELATED TO ACTION ITEMS 3A, B AND C MAY BE INITIATED SIMULTANEOUSLY WITH ACTION ITEM 4.

Action Item 4. Conduct basinwide habitat survey.

Who: Monongahela NF, Forest Service Research.

What: Comprehensive basinwide habitat survey, including pertinent measurements on the selected subset of aquatic systems (ie. streams, vernal pools, and wetlands), to establish baseline.

How Often: Once.

Cost/$: $15-20K.

Priority: 4.

Action Item 5. Inventory threatened, endangered and sensitive species of aquatic vegetation present in wetlands.

Who: Contractor (WVDNR, US Fish & Wildlife Service, University).

What: Inventory threatened, endangered and sensitive species of aquatic vegetation present in wetlands, but only on a subset of wetlands based on habitat.

How Often: Once.

Cost/$: $5-10K.

Priority: 5.

Action Item 6. Inventory algal species present in all types of aquatic systems.

Who: University.

What: Inventory algal species present in all types of aquatic systems, (ie. streams, vernal pools and wetlands). Tie to different pH classes.

How Often: Once.

Cost/$: $5K.

Priority: 6.

Workshop Objective 3. Develop methods to detect changes and trends in the condition of sensitive indicators.

Our goal is to collect monitoring data at a frequency that will allow detection and interpretation of any significant air pollution effect on wilderness AQRVs. Sampling design will depend on the characteristics of the parameter being measured.

Most of the monitoring data collected will serve the dual purpose of facilitating immediate decisions on air pollution effects on AQRVS and identification of trends associated with air pollution effects.

Monitoring data sets will have long and short term objectives. Short term utilization of data will allow immediate decisions on the current condition of resources in Dolly Sods and Otter Creek Wildernesses. Long term monitoring will be used to identify trends and develop long range plans for protecting the Class I area ecosystem.

Geochemical and biological monitoring intensity are projected based on the current information about wildernesses and the indicators that will be measured. Monitoring frequencies may be adjusted as we learn more about the indicators. After five years, data will be evaluated for each indicator to determine natural variability and trends. If appropriate, the sampling frequency will be adjusted based on the evaluation results.

MONITORING OF TERRESTRIAL RESOURCES.

Action Item 1. Continue air quality monitoring on the National Forest, and at the Northeastern Forest Experiment Station in Parsons, WV.

Who: USFS Research, Project RWU-4301.

What: Continue monitoring air quality and visibility at selected sites near the Class 1 wildernesses. Include NDDN site at Parsons, gaseous components at Bearden Knob high elevation site, and visibility/IMPROVE site at Bearden Knob.

How Often: Continuous monitoring.

Cost/$: NDDN: $5200-7500.
Gaseous: $30K.
Visibility/IMPROVE: $20-25K/site.

Action Item 2. Continue foliar ozone injury assessment.

Who: USFS Forest Health Protection.

What: Foliar ozone injury assessment, in both Class 1 wildernesses, for 15 species.

How Often: Annually.

Cost/$:

Priority: 2.

Action Item 3. Monitor lichen community.

Who: University.

What: Monitor lichen community in both Class 1 wildernesses. Include community structure, abundance and distribution. Include elemental analysis of selected lichen species.

How Often: Every 5 years.

Cost/$: $25K.

Priority: 3.

Action Item 4. Monitor Cheat Mountain Salamander, and insect lichen-eaters.

Who: Contractor (US Fish & Wildlife Service, other).

What: Monitor populations, abundance of species potentially most sensitive to acid deposition effects. (See indicators list.)

How Often: Cheat Mountain Salamander, every three years.
Lichen-eaters, annually.

Cost/$: Cheat Mountain Salamander, Virginia Northern Flying Squirrel: $5K.
Lichen-eaters: $10K

Priority: 4.

MONITORING OF AQUATIC RESOURCES.

Action Item 1. Monitor conditions and trends of the aquatic system.

Action Item 1a. Chemical Composition.

Who: National Forest.

What: Conduct quarterly sampling of chemical composition in all components of the aquatic system. Sample sites selected from the previously identified subsets, based on synoptic overview response classes. Do all constituents for the first five years. Evaluate needs after first five years, and adjust if necessary.

How Often: Quarterly, for the first five years.

Cost/$: $10K per year.

Priority: 1.

Action Item 1b. Episodic response for water quality parameters.

Who: National Forest and USFS Research do collection and analysis. University does aluminum analysis.

What: Monitor episodic streamflow events for the following water quality parameters: ANC, pH, aluminum (monomeric and dissolved), DOC, anions, cations, silica, conductivity and flow volume. Do all species of aluminum and establish relationships, to predict various fractions from total dissolved. (Include snowmelt event if it is a "significant" event.) For each event, sample two times each day for the duration of the event, which may be from 1 day to 1 week (based upon stream chemistry returning to baseflow chemistry conditions.)

How Often: Do annually, minimum of 2 events per year.

Cost/$: $6K each year.

Priority: 2.

Action Item 1c. Biological Composition -- Fish.

Who: National Forest, WVDNR, USFS Research.

What: Monitor fish community composition/abundance within the same reaches over time. Number of reaches based on response classes. Monitor once each spring and once in the late summer/early fall, on a three year interval. Make adjustment in the sampling frequency after that.

How Often: Twice per year, every third year.

Cost/$: $5K each year it is done.

Priority: 3a.

Action Item 1d. Biological Composition -- Amphibians.

Who: University.

What: In streams (1st and 2nd order streams only):
* monitor larvae and adults, spring and fall.

In vernal pools and wetlands:
* monitor egg masses for 1 month at weekly intervals; monitor larvae once in spring and once in summer.
* monitor adults yearly.
* include water chemistry.

How Often: During window of opportunity, March to October; on 3 year cycle.

Cost/$: $5K each year it is done.

Priority: 3b.

Action Item 1e. Biological Composition -- Macroinvertebrates.

Who: Monongahela NF for sample collections; University or USFS Research for the identifications.

What: Sample, identify and quantify macroinvertebrate community at appropriate subset of sample locations. Sample 10 times throughout the year, then re-sample in year 3 with same sample intensity. Every three years re-sample intensively, although intensity may be altered.

How Often: 10 times per year, every 3rd year.

Cost/$: $20K each year it is done.

Priority: 3c.

Action Item 2. Monitor threatened, endangered and sensitive species of aquatic vegetation present in wetlands.

Who: Monongahela NF, WVDNR, University.

What: Monitor threatened, endangered and sensitive species of aquatic wetland vegetation.

How Often: Once per year, every three years.

Cost/$: $2-5K per year monitored, depending on what's there initially.

Priority: 4.

Action Item 3. Monitor algal species present in all types of aquatic systems.

Who: University.

What: Monitor (qualitative) algal species present in all types of aquatic systems: streams, vernal pools, and wetlands.

How Often: Once per year, every third year.

Cost/$: $2-5K per year monitored.

Priority: 5.

RESEARCH NEEDS.

In addition to the above identified action items, a large number of research needs topics were identified in the workgroups, which are listed below.

Air Quality and Deposition

A. Determine and quantify if reductions in deposition actually have occurred, after new Clean Air Act laws come into effect.

B. Evaluate cloud contributions to deposition.

C. Describe the relation of AQRV's to air quality using existing monitoring data.

D. Evaluate location of air quality monitors relative to damage assessment. Is the monitoring network providing us with information at an appropriate scale (ie, do we need more monitors)? Can we relate monitoring data with damage data?

Terrestrial Research Needs

A. Quantify and describe the sulfur budget for Class 1 wilderness soils.

B. Determine the nitrogen saturation status of Class 1 wilderness areas.

C. Determine the effect of gypsy moth on ecosystem responses; it will confound results. Consider gypsy moth effects in relation to nitrogen response.

D. Sampling frequency for lichens: dose-response in field or lab.

E. Transplant studies: clonal material for sensitive tree species, lichens.

F. Foliar injury related to forest health via ecological processes.

G. Nutrients in foliage relative to injury.

H. Relationship of defoliation to reproduction, physiology.

I. Fungi/slime molds.

J. Dose-phenology of injury.

K. Are threatened and endangered plants and animals sensitive to air pollution? An assessment and comparison of relative sensitivity is needed.

L. Salamanders: sodium efflux laboratory study.

M. Insects: What are effects of pollutants on insects? (fumigation studies). What soil invertebrates are common in the wildernesses? How are they affected by the chemical climate?

N. Incorporation of wilderness research in GAP analysis project (Fish and Wildlife Service).

Aquatic Research Needs

A. Determine sources of acidity in Class 1 area aquatic resources:
   - natural vs. anthropogenic
   - organic vs. sulfatic

B. Determine the effects of water quality on macroinvertebrates using toxicological techniques. Describe how particular pollutant levels affect macroinvertebrates.

C. Test the Jefferson National Forest aquatic model that predicts change in aquatic chemistry from individual sources of air pollution for applicability in Monongahela National Forest Class I areas.

Critical Loads and Aesthetics Research Needs

A. Determine critical loads for these wildernesses with respect to acidic deposition. Where do we need to be in order to reverse adverse effects, attain a desired future condition?

B. Aesthetics and public perception. When does air pollution affect aesthetics and perception of wilderness values?

Dispersion Modeling Research Needs

A. Explore the application of dispersion modeling to:
   1. reduce deposition to levels necessary to correct adverse effects on AQRV's.
   2. determine effects of Clean Air Act reductions on AQRV's.

B. "F-factor" models.
   (measurement protocols--check on siting).

C. Develop the capability to model soil responses in Monongahela Class I areas.

Appendix 1
Workshop Participants

Dr. James D. Lawrey
Department of Biology
George Mason University
4400 University Drive
Fairfax, VA 22030-4444

Mr. James R. Webb
Dept. of Environmental Sciences
University of Virginia
Clark Hall
Charlottesville, VA 22903

Ms. Catherine Brown (3ES11)
US-EPA Region 3, Environmental Services
841 Chestnut Building
Philadelphia, PA 19107

Ms. Cindy Huber
Jefferson National Forest
210 Franklin Rd., S.W.
Caller Service 2900
Roanoke, VA 24001

Mr. Robert L. Weser, P.E.
WV Office of Air Quality
1558 Washington Street, East
Charleston, WV 25311-2599

Dr. Frank Gilliam
Dept. of Biological Sciences
Marshall University
Huntington, WV 25701

Dr. Sue Perry
Coop. Fish & Wildlife Research Unit
Percival Hall
West Virginia University
Morgantown, WV 26506-6125

Dr. Tom Pauley
Dept. of Biological Sciences
Marshall University
Huntington, WV 25701

Dr. Linda Butler
Div. of Plant & Soil Science
P.O. Box 6108
West Virginia University
Morgantown, WV 26506-6108

Dr. Dale Nichols
Forestry Science Laboratory
1831 Hwy. 169E
Grand Rapids, MN 55744

Ms. Pamela J. Edwards
Timber & Watershed Laboratory
P.O. Box 404
Parsons, WV 26287

Dr. John M. Skelley
Penn State University
Dept. of Plant Pathology, 108 Buckhout
University Park, PA 16803

Ms. Eileen M. Glen
Deputy Chief, Air Enforcement Branch
USEPA-Region III
841 Chestnut Building
Philadelphia, PA 19107

Ms. Julie Thomas
Shenandoah National Park
Route 4, Box 348
Luray, VA 22835-9051

Ms. Beth Brantley
USDA Forest Service, Forest Pest Management
P.O. Box 2680
Asheville, NC 28802

Mr. Kenneth McBee
Virginia Department of Air Pollution Control
Room 801, Ninth Street Office Building
P.O. Box 10089
Richmond, VA 23240

Mr. Daniel Twardus
NE Area State & Private Forestry
180 Canfield Street
Morgantown, WV 26505

Dr. Jerome Thomas
USDA Forest Service, Eastern Region
310 W. Wisconsin Ave.
Milwaukee, WI 53203

Mr. Rick Landenberger
Cheat Ranger District
P.O. Box 368
Parsons, WV 26287

Dr. Mary Wimmer
Dept. of Biochemistry
WVU Health Sciences Center
P.O. Box 9142
Morgantown, WV 26506-9142

Mr. Michael Housley
LG&E Power Systems
12500 Fair Lakes Circle
Suite 260
Fairfax, VA 22033-3822

Mr. Robert Beasley
Virginia Department of Air Pollution Control
Room 801, Ninth Street Office Building
P.O. Box 10089
Richmond, VA 23240

Ms. Karen Malkin
USDI-NPS, Air Quality Division
MS 3229
1849 C Street, NW
Washington, D.C. 20240

Mr. William Paul
Maryland Air & Radiation Management Admin.
Department of the Environment
2500 Broening Highway
Baltimore, MD 21224

Ms. Nancy Feakes
Potomac Ranger District
HC 59, Box 240
Petersburg, WV 26847

Mr. William C. Woodland
Cheat Ranger District
P.O. Box 368
Parsons, WV 26287

Mr. Mike Herth
Monongahela National Forest
200 Sycamore Street
Elkins, WV 26241

Money Available
Wilderness funds
Soil Water Air
94
↑ $21,000
↓

Mr. Richard C. Trochlil
Monongahela National Forest
200 Sycamore Street
Elkins, WV 26241

Mr. Martin MacKenzie
NE Area State & Private Forestry
180 Canfield Street
Morgantown, WV 26505

Mr. William Sharpe
ERRI
Penn State University
University Park, PA 16802

Mr. James Browder
Virginia Department of Air Pollution Control
Room 801, Ninth Street Office Building
P.O. Box 10089
Richmond, VA 23240

Dr. Mary Beth Adams
USDA Forest Service
Timber and Watershed Lab
Box 404
Parsons, WV 26287

Mr. Barry Edgerton
USDA Forest Service
Monongahela National Forest
200 Sycamore Street
Elkins, WV 26241